This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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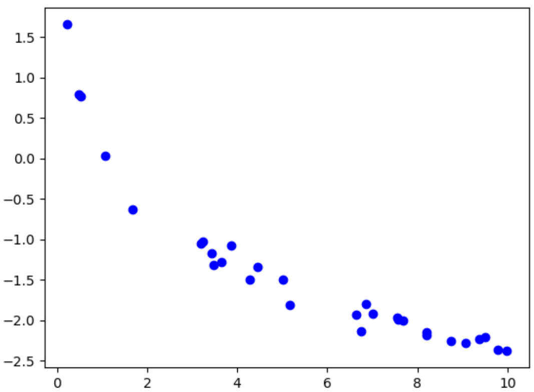
1. Determine the appropriate model for the graph of points below.



The solution is Logarithmic model, which is option A.

A. Logarithmic model

For this to be the correct option, we want a rapid change early, then an extremely slow change later.

B. Non-linear Power model

For this to be the correct option, we need to see a polynomial or rational shape.

C. Linear model

For this to be the correct option, we need to see a mostly straight line of points.

D. Exponential model

For this to be the correct option, we want an extremely slow change early, then a rapid change later.

E. None of the above

For this to be the correct option, we want to see no pattern in the points.

General Comment: This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

---

2. The temperature of an object, T, in a different surrounding temperature T_s will behave according to the formula $T(t) = Ae^{kt} + T_s$, where t is minutes, A is a constant, and k is a constant. Use this formula and the situation below to construct a model that describes the uranium's temperature, T, based on

the amount of time t (in minutes) that have passed. Choose the correct constant k from the options below.

Uranium is taken out of the reactor with a temperature of $140°$ *C and is placed into a* $13°$ *C bath to cool. After 38 minutes, the uranium has cooled to* $75°$ *C.*

The solution is $k = -0.01887$, which is option D.

A. $k = -0.02143$

This uses A as the initial temperature and solves for k correctly.

B. $k = -0.01858$

This uses A correctly but solves for k incorrectly.

C. $k = -0.01828$

This uses A as the initial temperature and solves for k incorrectly.

D. $k = -0.01887$

* This is the correct option.

E. None of the above

If you chose this, please contact the coordinator to discuss why you believe none of the other answers are correct.

General Comment: The initial temperature is when $t = 0$. Unlike power models, that means A is not the initial temperature!

---

3. Using the scenario below, model the population of bacteria α in terms of the number of minutes, t that pass. Then, choose the correct approximate *(rounded to the nearest minute)* replication rate of bacteria-α.

A newly discovered bacteria, α*, is being examined in a lab. The lab started with a petri dish of 2 bacteria-*α*. After 1 hours, the petri dish has 18 bacteria-*α*. Based on similar bacteria, the lab believes bacteria-*α *quadruples after some undetermined number of minutes.*

The solution is About 36 minutes, which is option D.

A. About 254 minutes

This does not solve for the constant correctly AND converted incorrectly.

B. About 42 minutes

This does not solve for the constant correctly.

C. About 221 minutes

This solves for the constant correctly but converted incorrectly.

D. About 36 minutes

* This is the correct option.

E. None of the above

Please contact the coordinator to discuss why you believe none of the answers above are correct.

General Comment: Your model should be $P(t) = P_0(b)^{kt}$, where $P(t)$ is the population at some time t, P_0 is the initial population, and k is the replication rate. Be sure you convert the hours into minutes!

4. Using the scenario below, model the situation using an exponential function and a base of $\frac{1}{2}$. Then, solve for the half-life of the element, rounding to the nearest day.

The half-life of an element is the amount of time it takes for the element to decay to half of its initial starting amount. There is initially 800 grams of element X and after 4 years there is 160 grams remaining.

The solution is About 365 days, which is option B.

A. About 1 day

This models half-life as a linear function.

B. About 365 days

* This is the correct option.

C. About 730 days

This uses the correct model but a base of e rather than $\frac{1}{2}$.

D. About 1460 days

This uses the correct model but solves for the exponential constant incorrectly.

E. None of the above

Please contact the coordinator if you believe all the options above are incorrect.

General Comment: The model should be $A(t) = A_0(\frac{1}{2})^{kt}$, where $A(t)$ is the amount after t years, A_0 is the initial amount, and k is decay constant. To find the half-life, you need to solve for k by using the amount after x years, then solve for the time t when $A = \frac{A_0}{2}$. Your answer would be in years, so convert to days.

5. Using the scenario below, model the population of bacteria α in terms of the number of minutes, t that pass. Then, choose the correct approximate *(rounded to the nearest minute)* replication rate of bacteria-α.

A newly discovered bacteria, α, is being examined in a lab. The lab started with a petri dish of 4 bacteria-α. After 2 hours, the petri dish has 243 bacteria-α. Based on similar bacteria, the lab believes bacteria-α triples after some undetermined number of minutes.

The solution is About 32 minutes, which is option C.

A. About 325 minutes

This does not solve for the constant correctly AND converted incorrectly.

B. About 192 minutes

This solves for the constant correctly but converted incorrectly.

C. About 32 minutes

* This is the correct option.

D. About 54 minutes

This does not solve for the constant correctly.

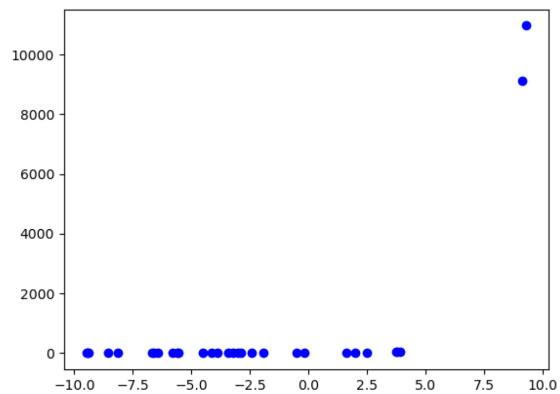
E. None of the above

Please contact the coordinator to discuss why you believe none of the answers above are correct.

General Comment: Your model should be $P(t) = P_0(b)^{kt}$, where $P(t)$ is the population at some time t, P_0 is the initial population, and k is the replication rate. Be sure you convert the hours into minutes!

---

6. Determine the appropriate model for the graph of points below.



The solution is Exponential model, which is option A.

A. Exponential model

For this to be the correct option, we want an extremely slow change early, then a rapid change later.

B. Non-linear Power model

For this to be the correct option, we need to see a polynomial or rational shape.

C. Logarithmic model

For this to be the correct option, we want a rapid change early, then an extremely slow change later.

D. Linear model

For this to be the correct option, we need to see a mostly straight line of points.

E. None of the above

For this to be the correct option, we want to see no pattern in the points.

General Comment: This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

---

7. A town has an initial population of 20000. The town's population for the next 10 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	20120	20360	21080	23240	29720	49160	107480	282440	807320

The solution is Exponential, which is option A.

A. Exponential

   This suggests the fastest of growths that we know.

B. Logarithmic

   This suggests the slowest of growths that we know.

C. Linear

   This suggests a constant growth. You would be able to add or subtract the same amount year-to-year if this is the correct answer.

D. Non-Linear Power

   This suggests a growth faster than constant but slower than exponential.

E. None of the above

   Please contact the coordinator to discuss why you believe none of the options model the population.

General Comment: We are trying to compare the growth rate of the population. Growth rates can be characterized from slowest to fastest as: logarithmic, indirect, linear, direct, exponential. The best way to approach this is to first compare it to linear (is it linear, faster than linear, or slower than linear)? If faster, is it as fast as exponential? If slower, is it as slow as logarithmic?

---

8. The temperature of an object, T, in a different surrounding temperature T_s will behave according to the formula $T(t) = Ae^{kt} + T_s$, where t is minutes, A is a constant, and k is a constant. Use this formula and the situation below to construct a model that describes the uranium's temperature, T, based on the amount of time t (in minutes) that have passed. Choose the correct constant k from the options below.

Uranium is taken out of the reactor with a temperature of $170°$ *C and is placed into a* $17°$ *C bath to cool. After 30 minutes, the uranium has cooled to* $118°$ *C.*

The solution is None of the above, which is option E.

A. $k = -0.02507$

   This uses A as the initial temperature and solves for k incorrectly.

B. $k = -0.02551$

   This uses A correctly and solves for k incorrectly.

C. $k = -0.01736$

   This uses A as the initial temperature and solves for k correctly.

D. $k = -0.04013$

   This uses A as the bath temperature and solves for k incorrectly.

E. None of the above

   * This is the correct answer as $k = -0.01384$.

General Comment: The initial temperature is when $t = 0$. Unlike power models, that means A is not the initial temperature!

---

9. Using the scenario below, model the situation using an exponential function and a base of $\frac{1}{2}$. Then, solve for the half-life of the element, rounding to the nearest day.

The half-life of an element is the amount of time it takes for the element to decay to half of its initial starting amount. There is initially 510 grams of element X and after 6 years there is 72 grams remaining.

The solution is About 730 days, which is option D.

A. About 1 day

This models half-life as a linear function.

B. About 1095 days

This uses the correct model but a base of e rather than $\frac{1}{2}$.

C. About 2555 days

This uses the correct model but solves for the exponential constant incorrectly.

D. About 730 days

* This is the correct option.

E. None of the above

Please contact the coordinator if you believe all the options above are incorrect.

General Comment: The model should be $A(t) = A_0(\frac{1}{2})^{kt}$, where $A(t)$ is the amount after t years, A_0 is the initial amount, and k is decay constant. To find the half-life, you need to solve for k by using the amount after x years, then solve for the time t when $A = \frac{A_0}{2}$. Your answer would be in years, so convert to days.

---

10. A town has an initial population of 90000. The town's population for the next 10 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	89840	89360	87440	79760	49040	0	0	0	0

The solution is Exponential, which is option A.

A. Exponential

This suggests the fastest of growths that we know.

B. Logarithmic

This suggests the slowest of growths that we know.

C. Linear

This suggests a constant growth. You would be able to add or subtract the same amount year-to-year if this is the correct answer.

D. Non-Linear Power

This suggests a growth faster than constant but slower than exponential.

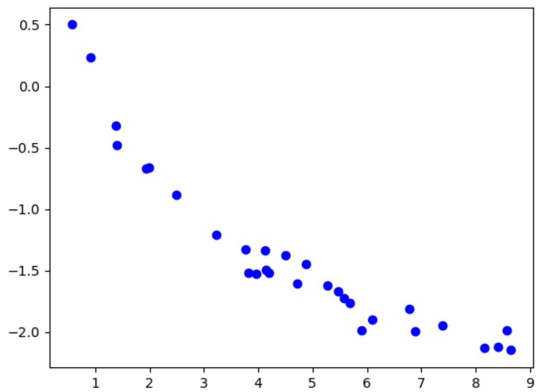
E. None of the above

Please contact the coordinator to discuss why you believe none of the options model the population.

General Comment: We are trying to compare the growth rate of the population. Growth rates can be characterized from slowest to fastest as: logarithmic, indirect, linear, direct, exponential. The best way to approach this is to first compare it to linear (is it linear, faster than linear, or slower than linear)? If faster, is it as fast as exponential? If slower, is it as slow as logarithmic?

---

11. Determine the appropriate model for the graph of points below.



The solution is Logarithmic model, which is option B.

A. Non-linear Power model

   For this to be the correct option, we need to see a polynomial or rational shape.

B. Logarithmic model

   For this to be the correct option, we want a rapid change early, then an extremely slow change later.

C. Linear model

   For this to be the correct option, we need to see a mostly straight line of points.

D. Exponential model

   For this to be the correct option, we want an extremely slow change early, then a rapid change later.

E. None of the above

   For this to be the correct option, we want to see no pattern in the points.

General Comment: This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

---

12. The temperature of an object, T, in a different surrounding temperature T_s will behave according to the formula $T(t) = Ae^{kt} + T_s$, where t is minutes, A is a constant, and k is a constant. Use this formula and the situation below to construct a model that describes the uranium's temperature, T, based on the amount of time t (in minutes) that have passed. Choose the correct constant k from the options below.

Uranium is taken out of the reactor with a temperature of $130°$ *C and is placed into a* $18°$ *C bath to cool. After 21 minutes, the uranium has cooled to* $83°$ *C.*

The solution is None of the above, which is option E.

A. $k = -0.03388$

This uses A as the initial temperature and solves for k incorrectly.

B. $k = -0.03301$

This uses A as the initial temperature and solves for k correctly.

C. $k = -0.03476$

This uses A correctly and solves for k incorrectly.

D. $k = -0.05110$

This uses A as the bath temperature and solves for k incorrectly.

E. None of the above

* This is the correct answer as $k = -0.02591$.

General Comment: The initial temperature is when $t = 0$. Unlike power models, that means A is not the initial temperature!

---

13. Using the scenario below, model the population of bacteria α in terms of the number of minutes, t that pass. Then, choose the correct approximate *(rounded to the nearest minute)* replication rate of bacteria-α.

A newly discovered bacteria, α, is being examined in a lab. The lab started with a petri dish of 4 bacteria-α. After 1 hours, the petri dish has 29 bacteria-α. Based on similar bacteria, the lab believes bacteria-α doubles after some undetermined number of minutes.

The solution is About 20 minutes, which is option D.

A. About 221 minutes

This does not solve for the constant correctly AND converted incorrectly.

B. About 36 minutes

This does not solve for the constant correctly.

C. About 125 minutes

This solves for the constant correctly but converted incorrectly.

D. About 20 minutes

* This is the correct option.

E. None of the above

Please contact the coordinator to discuss why you believe none of the answers above are correct.

General Comment: Your model should be $P(t) = P_0(b)^{kt}$, where $P(t)$ is the population at some time t, P_0 is the initial population, and k is the replication rate. Be sure you convert the hours into minutes!

---

14. Using the scenario below, model the situation using an exponential function and a base of $\frac{1}{2}$. Then, solve for the half-life of the element, rounding to the nearest day.

The half-life of an element is the amount of time it takes for the element to decay to half of its initial starting amount. There is initially 502 grams of element X and after 10 years there is 50 grams remaining.

The solution is About 1095 days, which is option D.

A. About 1 day

   This models half-life as a linear function.

B. About 5110 days

   This uses the correct model but solves for the exponential constant incorrectly.

C. About 1460 days

   This uses the correct model but a base of e rather than $\frac{1}{2}$.

D. About 1095 days

   * This is the correct option.

E. None of the above

   Please contact the coordinator if you believe all the options above are incorrect.

General Comment: The model should be $A(t) = A_0(\frac{1}{2})^{kt}$, where $A(t)$ is the amount after t years, A_0 is the initial amount, and k is decay constant. To find the half-life, you need to solve for k by using the amount after x years, then solve for the time t when $A = \frac{A_0}{2}$. Your answer would be in years, so convert to days.

---

15. Using the scenario below, model the population of bacteria α in terms of the number of minutes, t that pass. Then, choose the correct approximate *(rounded to the nearest minute)* replication rate of bacteria-α.

A newly discovered bacteria, α, is being examined in a lab. The lab started with a petri dish of 3 bacteria-α. After 3 hours, the petri dish has 11136 bacteria-α. Based on similar bacteria, the lab believes bacteria-α triples after some undetermined number of minutes.

The solution is None of the above, which is option E.

A. About 15 minutes

   This uses the wrong base.

B. About 34 minutes

   This uses the wrong base and does not solve for the constant correctly.

C. About 91 minutes

   This uses the wrong base and solves for the constant correctly but converted incorrectly.

D. About 207 minutes

   This uses the wrong base, does not solve for the constant correctly, AND converted incorrectly.

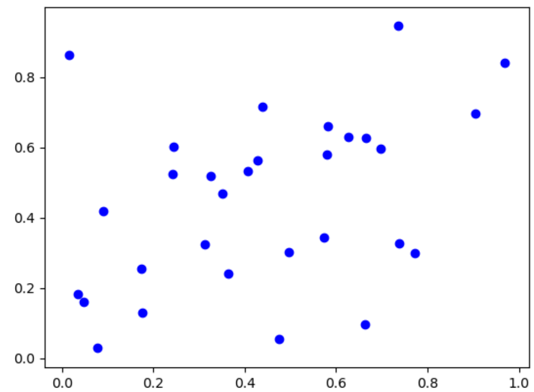
E. None of the above

   * This is the correct option as all other options used the wrong base in their model.

General Comment: Your model should be $P(t) = P_0(b)^{kt}$, where $P(t)$ is the population at some time t, P_0 is the initial population, and k is the replication rate. Be sure you convert the hours into minutes!

---

16. Determine the appropriate model for the graph of points below.



The solution is None of the above, which is option E.

A. Linear model

For this to be the correct option, we need to see a mostly straight line of points.

B. Logarithmic model

For this to be the correct option, we want a rapid change early, then an extremely slow change later.

C. Non-linear Power model

For this to be the correct option, we need to see a polynomial or rational shape.

D. Exponential model

For this to be the correct option, we want an extremely slow change early, then a rapid change later.

E. None of the above

For this to be the correct option, we want to see no pattern in the points.

General Comment: This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

---

17. A town has an initial population of 40000. The town's population for the next 10 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	40000	39986	39978	39972	39967	39964	39961	39958	39956

The solution is Logarithmic, which is option A.

A. Logarithmic

This suggests the slowest of growths that we know.

B. Linear

This suggests a constant growth. You would be able to add or subtract the same amount year-to-year if this is the correct answer.

C. Exponential

This suggests the fastest of growths that we know.

D. Non-Linear Power

This suggests a growth faster than constant but slower than exponential.

E. None of the above

Please contact the coordinator to discuss why you believe none of the options model the population.

General Comment: We are trying to compare the growth rate of the population. Growth rates can be characterized from slowest to fastest as: logarithmic, indirect, linear, direct, exponential. The best way to approach this is to first compare it to linear (is it linear, faster than linear, or slower than linear)? If faster, is it as fast as exponential? If slower, is it as slow as logarithmic?

---

18. The temperature of an object, T, in a different surrounding temperature T_s will behave according to the formula $T(t) = Ae^{kt} + T_s$, where t is minutes, A is a constant, and k is a constant. Use this formula and the situation below to construct a model that describes the uranium's temperature, T, based on the amount of time t (in minutes) that have passed. Choose the correct constant k from the options below.

Uranium is taken out of the reactor with a temperature of $150°$ C and is placed into a $12°$ C bath to cool. After 22 minutes, the uranium has cooled to $94°$ C.

The solution is None of the above, which is option E.

A. $k = -0.03379$

This uses A correctly and solves for k incorrectly.

B. $k = -0.05748$

This uses A as the bath temperature and solves for k incorrectly.

C. $k = -0.03333$

This uses A as the initial temperature and solves for k incorrectly.

D. $k = -0.02745$

This uses A as the initial temperature and solves for k correctly.

E. None of the above

* This is the correct answer as $k = -0.02366$.

General Comment: The initial temperature is when $t = 0$. Unlike power models, that means A is not the initial temperature!

---

19. Using the scenario below, model the situation using an exponential function and a base of $\frac{1}{2}$. Then, solve for the half-life of the element, rounding to the nearest day.

The half-life of an element is the amount of time it takes for the element to decay to half of its initial starting amount. There is initially 994 grams of element X and after 6 years there is 110 grams remaining.

The solution is About 365 days, which is option D.

A. About 1 day

This models half-life as a linear function.

B. About 2555 days

This uses the correct model but solves for the exponential constant incorrectly.

C. About 730 days

This uses the correct model but a base of e rather than $\frac{1}{2}$.

D. About 365 days

* This is the correct option.

E. None of the above

Please contact the coordinator if you believe all the options above are incorrect.

General Comment: The model should be $A(t) = A_0(\frac{1}{2})^{kt}$, where $A(t)$ is the amount after t years, A_0 is the initial amount, and k is decay constant. To find the half-life, you need to solve for k by using the amount after x years, then solve for the time t when $A = \frac{A_0}{2}$. Your answer would be in years, so convert to days.

---

20. A town has an initial population of 20000. The town's population for the next 10 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	20000	20027	20043	20055	20064	20071	20077	20083	20087

The solution is Logarithmic, which is option C.

A. Non-Linear Power

This suggests a growth faster than constant but slower than exponential.

B. Exponential

This suggests the fastest of growths that we know.

C. Logarithmic

This suggests the slowest of growths that we know.

D. Linear

This suggests a constant growth. You would be able to add or subtract the same amount year-to-year if this is the correct answer.

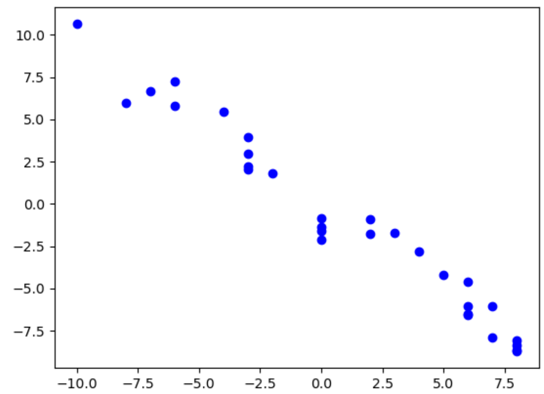
E. None of the above

Please contact the coordinator to discuss why you believe none of the options model the population.

General Comment: We are trying to compare the growth rate of the population. Growth rates can be characterized from slowest to fastest as: logarithmic, indirect, linear, direct, exponential. The best way to approach this is to first compare it to linear (is it linear, faster than linear, or slower than linear)? If faster, is it as fast as exponential? If slower, is it as slow as logarithmic?

---

21. Determine the appropriate model for the graph of points below.



The solution is Linear model, which is option C.

A. Non-linear Power model

   For this to be the correct option, we need to see a polynomial or rational shape.

B. Logarithmic model

   For this to be the correct option, we want a rapid change early, then an extremely slow change later.

C. Linear model

   For this to be the correct option, we need to see a mostly straight line of points.

D. Exponential model

   For this to be the correct option, we want an extremely slow change early, then a rapid change later.

E. None of the above

   For this to be the correct option, we want to see no pattern in the points.

General Comment: This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

---

22. The temperature of an object, T, in a different surrounding temperature T_s will behave according to the formula $T(t) = Ae^{kt} + T_s$, where t is minutes, A is a constant, and k is a constant. Use this formula and the situation below to construct a model that describes the uranium's temperature, T, based on the amount of time t (in minutes) that have passed. Choose the correct constant k from the options below.

Uranium is taken out of the reactor with a temperature of $100°$ *C and is placed into a* $13°$ *C bath to cool. After 36 minutes, the uranium has cooled to* $50°$ *C.*

The solution is None of the above, which is option E.

A. $k = -0.02762$

   This uses A as the initial temperature and solves for k correctly.

B. $k = -0.01789$

   This uses A as the initial temperature and solves for k incorrectly.

C. $k = -0.01835$

This uses A correctly and solves for k incorrectly.

D. $k = -0.02814$

This uses A as the bath temperature and solves for k incorrectly.

E. None of the above

* This is the correct answer as $k = -0.02375$.

General Comment: The initial temperature is when $t = 0$. Unlike power models, that means A is not the initial temperature!

---

23. Using the scenario below, model the population of bacteria α in terms of the number of minutes, t that pass. Then, choose the correct approximate *(rounded to the nearest minute)* replication rate of bacteria-α.

A newly discovered bacteria, α, is being examined in a lab. The lab started with a petri dish of 3 bacteria-α. After 1 hours, the petri dish has 80 bacteria-α. Based on similar bacteria, the lab believes bacteria-α triples after some undetermined number of minutes.

The solution is About 20 minutes, which is option D.

A. About 180 minutes

This does not solve for the constant correctly AND converted incorrectly.

B. About 30 minutes

This does not solve for the constant correctly.

C. About 120 minutes

This solves for the constant correctly but converted incorrectly.

D. About 20 minutes

* This is the correct option.

E. None of the above

Please contact the coordinator to discuss why you believe none of the answers above are correct.

General Comment: Your model should be $P(t) = P_0(b)^{kt}$, where $P(t)$ is the population at some time t, P_0 is the initial population, and k is the replication rate. Be sure you convert the hours into minutes!

---

24. Using the scenario below, model the situation using an exponential function and a base of $\frac{1}{2}$. Then, solve for the half-life of the element, rounding to the nearest day.

The half-life of an element is the amount of time it takes for the element to decay to half of its initial starting amount. There is initially 992 grams of element X and after 2 years there is 198 grams remaining.

The solution is About 0 days, which is option A.

A. About 0 days

* This is the correct option.

B. About 365 days

This uses the correct model but a base of e rather than $\frac{1}{2}$.

C. About 1 day

This models half-life as a linear function.

D. About 730 days

This uses the correct model but solves for the exponential constant incorrectly.

E. None of the above

Please contact the coordinator if you believe all the options above are incorrect.

General Comment: The model should be $A(t) = A_0(\frac{1}{2})^{kt}$, where $A(t)$ is the amount after t years, A_0 is the initial amount, and k is decay constant. To find the half-life, you need to solve for k by using the amount after x years, then solve for the time t when $A = \frac{A_0}{2}$. Your answer would be in years, so convert to days.

---

25. Using the scenario below, model the population of bacteria α in terms of the number of minutes, t that pass. Then, choose the correct approximate *(rounded to the nearest minute)* replication rate of bacteria-α.

A newly discovered bacteria, α, is being examined in a lab. The lab started with a petri dish of 4 bacteria-α. After 1 hours, the petri dish has 79 bacteria-α. Based on similar bacteria, the lab believes bacteria-α quadruples after some undetermined number of minutes.

The solution is None of the above, which is option E.

A. About 13 minutes

This uses the wrong base.

B. About 83 minutes

This uses the wrong base and solves for the constant correctly but converted incorrectly.

C. About 170 minutes

This uses the wrong base, does not solve for the constant correctly, AND converted incorrectly.

D. About 28 minutes

This uses the wrong base and does not solve for the constant correctly.

E. None of the above

* This is the correct option as all other options used the wrong base in their model.

General Comment: Your model should be $P(t) = P_0(b)^{kt}$, where $P(t)$ is the population at some time t, P_0 is the initial population, and k is the replication rate. Be sure you convert the hours into minutes!

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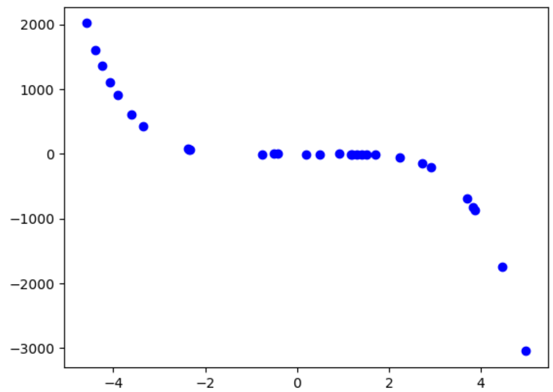
26. Determine the appropriate model for the graph of points below.



The solution is Non-linear Power model, which is option B.

A. Linear model

For this to be the correct option, we need to see a mostly straight line of points.

B. Non-linear Power model

For this to be the correct option, we need to see a polynomial or rational shape.

C. Logarithmic model

For this to be the correct option, we want a rapid change early, then an extremely slow change later.

D. Exponential model

For this to be the correct option, we want an extremely slow change early, then a rapid change later.

E. None of the above

For this to be the correct option, we want to see no pattern in the points.

General Comment: This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

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27. A town has an initial population of 80000. The town's population for the next 10 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	80000	79972	79956	79944	79935	79928	79922	79916	79912

The solution is Logarithmic, which is option B.

A. Linear

This suggests a constant growth. You would be able to add or subtract the same amount year-to-year if this is the correct answer.

B. Logarithmic

This suggests the slowest of growths that we know.

C. Non-Linear Power

This suggests a growth faster than constant but slower than exponential.

D. Exponential

This suggests the fastest of growths that we know.

E. None of the above

Please contact the coordinator to discuss why you believe none of the options model the population.

General Comment: We are trying to compare the growth rate of the population. Growth rates can be characterized from slowest to fastest as: logarithmic, indirect, linear, direct, exponential. The best way to approach this is to first compare it to linear (is it linear, faster than linear, or slower than linear)? If faster, is it as fast as exponential? If slower, is it as slow as logarithmic?

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28. The temperature of an object, T, in a different surrounding temperature T_s will behave according to the formula $T(t) = Ae^{kt} + T_s$, where t is minutes, A is a constant, and k is a constant. Use this formula and the situation below to construct a model that describes the uranium's temperature, T, based on the amount of time t (in minutes) that have passed. Choose the correct constant k from the options below.

Uranium is taken out of the reactor with a temperature of $180°$ *C and is placed into a* $19°$ *C bath to cool. After 38 minutes, the uranium has cooled to* $121°$ *C.*

The solution is $k = -0.01201$, which is option B.

A. $k = -0.01495$

This uses A as the initial temperature and solves for k correctly.

B. $k = -0.01201$

* This is the correct option.

C. $k = -0.01965$

This uses A as the initial temperature and solves for k incorrectly.

D. $k = -0.02001$

This uses A correctly but solves for k incorrectly.

E. None of the above

If you chose this, please contact the coordinator to discuss why you believe none of the other answers are correct.

General Comment: The initial temperature is when $t = 0$. Unlike power models, that means A is not the initial temperature!

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29. Using the scenario below, model the situation using an exponential function and a base of $\frac{1}{2}$. Then, solve for the half-life of the element, rounding to the nearest day.

The half-life of an element is the amount of time it takes for the element to decay to half of its initial starting amount. There is initially 876 grams of element X and after 4 years there is 125 grams remaining.

The solution is About 365 days, which is option A.

A. About 365 days

* This is the correct option.

B. About 1825 days

This uses the correct model but solves for the exponential constant incorrectly.

C. About 1 day

This models half-life as a linear function.

D. About 730 days

This uses the correct model but a base of e rather than $\frac{1}{2}$.

E. None of the above

Please contact the coordinator if you believe all the options above are incorrect.

General Comment: The model should be $A(t) = A_0(\frac{1}{2})^{kt}$, where $A(t)$ is the amount after t years, A_0 is the initial amount, and k is decay constant. To find the half-life, you need to solve for k by using the amount after x years, then solve for the time t when $A = \frac{A_0}{2}$. Your answer would be in years, so convert to days.

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30. A town has an initial population of 20000. The town's population for the next 10 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	20000	20020	20032	20041	20048	20053	20058	20062	20065

The solution is Logarithmic, which is option C.

A. Non-Linear Power

This suggests a growth faster than constant but slower than exponential.

B. Linear

This suggests a constant growth. You would be able to add or subtract the same amount year-to-year if this is the correct answer.

C. Logarithmic

This suggests the slowest of growths that we know.

D. Exponential

This suggests the fastest of growths that we know.

E. None of the above

Please contact the coordinator to discuss why you believe none of the options model the population.

General Comment: We are trying to compare the growth rate of the population. Growth rates can be characterized from slowest to fastest as: logarithmic, indirect, linear, direct, exponential. The best way to approach this is to first compare it to linear (is it linear, faster than linear, or slower than linear)? If faster, is it as fast as exponential? If slower, is it as slow as logarithmic?
